DUKE POWER COMPANY

OCONEE NUCLEAR STATION

OCONEE 1 CYCLE 18

STARTUP TESTING REPORT

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Startup Testing Report
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STARTUP TESTING REPORT

PART I

FUEL DESIGN

1.0 Summary

The Unit 1 Cycle 18 core consists of 177 fuel assemblies, each of which is a 15 by 15 array containing 208 fuel rods, 16 control guide tubes and one incore instrument guide tube. The fuel consists of dished-end, cylindrical pellets of uranium dioxide clad in cold worked Zircaloy-4.

The core loading for this cycle consists of 8 reinserted assemblies with 3.60 wt% U-235 (designated Batch 17C), 49 reinserted assemblies with 3.70 wt% U-235 (designated Batch 18B), 60 reinserted assemblies with 3.68 wt% U-235 (designated Batch 19), and 60 fresh fuel assemblies (designated Batch 20). Batches 19 and 20 are axial zoned with a 6 inch axial blanket region of 2.00 wt% U-235 at the top and bottom of each pin. The fresh fuel for Batch 20 consists of a new design using radial fuel rod enrichment zoning. The radial zones consist of 16 pins placed as shown in Enclosure 6.0. These 16 pins are loaded with a reduced enrichment of 3.31 wt% U-235. The rest of the assembly, the "central region", is enriched to 3.61 wt% U-235. The core periphery is composed of Batches 18B and 17C assemblies. Batch 20 assemblies are distributed throughout the core interior with the Batch 19 and remaining Batch 18B assemblies. The fuel assemblies in batches 19 and 20 have an average nominal fuel loading of 487.2 kg. Uranium. The fuel assemblies in batches 17C and 18B have a nominal fuel loading of 463.7 kg. Uranium.

Cycle 18 will operate in a rods-out, feed and bleed mode. Core reactivity control is supplied mainly by soluble boron and is supplemented by 61 full length Ag-In-Cd control rods and 44 burnable poison rod assemblies (BPRAs). In addition to the full length control rods, eight Inconel gray axial shaping rods (APSRs) are provided for additional control of the axial power distribution.

PART II

ZERO POWER PHYSICS TEST

1.0 Introduction and Summary

The Oconee 1 Cycle 18 Zero Power Physics Test (ZPPT) was conducted from 12/22/97 through 12/23/97 per Station Procedure PT/0/A/0711/01. The purpose of this testing was to verify the nuclear parameters upon which the Oconee 1 Cycle 18 Safety Analysis and Technical Specifications are based.

Zero Power Physics Testing measurements were made with reactor power controlled between 1.4×10^{-1} % full power and 3.3×10^{-3} % full power on the wide range nuclear instrumentation; reactivity insertions were maintained less than 1720 $\mu\rho$. RCS pressure and temperature were maintained at approximately 2155 psig and 532°F, respectively..

The following nuclear parameters were measured:

(a) All-Rods-Out Critical Boron Concentration (See Enclosure 1.0);

(b) Temperature and Moderator Coefficients of Reactivity (See Enclosure 2.0);

(c) Integral Rod Worth for Control Rod (CR) Groups 5, 6, and 7 (See Enclosure 2.0);

(d) Differential Boron Worth (See Enclosure 1.0).

The Reactivity Measurement and Analysis System (RMAS) computer was used to record RC pressure, RC temperature, intermediate range power levels, and control rod positions. Reactivity was calculated by the RMAS computer and output to a chart recorder.

On 12/23/97 at 1905, ZPPT was declared complete. All acceptance criteria were met.

2.0 Approach to Criticality

The Control Rod Drive Trip Time Test (CRDTTT) was performed on 12/22/97. The CRDTTT was performed entirely at hot shutdown conditions (i.e., > 1% $\Delta k/k$ shutdown) per station procedure PT/0/A/0300/01. Each group was withdrawn individually. The CRDTTT was completed with the acceptance criteria being satisfied.

Rod withdrawal was begun on 12/22/97 at 1650. During approach to criticality there was a problem latching Rod 7 in Group 5. All rods were inserted and Group 1 was returned to 50%. Rod withdrawal was again started at 0115 on 12/23/97. 1/M (inverse subcritical multiplication) vs. withdrawn rod worth plots were maintained throughout the approach to criticality. Criticality was achieved at 0432 on 12/23/97 with rod groups 1-6 at 100% wd, group 7 at 88% wd, group 8 at 35% wd, an RCS average temperature of 534°F, and an RCS boron concentration of 1979 ppmB.

3.0 Pre-Physics Measurements

After establishing stable conditions with the reactor critical, reactor power was slowly increased to verify and record NI overlap. The point of adding sensible heat was also determined. From the sensible heat determination, the upper testing limit on the wide range NIs (as indicated on the Control Room Chart) was established for ZPPT.

An on-line OAC reactimeter checkout was then performed by making reactivity insertions of about +230/-780 μρ, and measuring the associated doubling times. These doubling times were input to an off-line reactivity calculation and the results compared to the on-line reactivity values.

4.0 Physics Testing

A. Reactivity Coefficient Measurements

The temperature coefficient measurement was made while maintaining equilibrium boron concentration in the RCS, with CR Group 7 withdrawn to 88.8% wd and with APSR Group 8 at 35.0% wd. This measurement was made measuring the reactivity change associated with a ramp increase in RCS temperature of approximately 4.93°F, and the reactivity change associated with a subsequent decrease of 8.95°F. The data from the two temperature ramps was averaged using the ΔT magnitudes as weighting factors. The change in reactivity was divided by the change in RCS temperature to calculate the temperature coefficient. The measured temperature coefficient was corrected for the difference in RCS average test temperature and reference temperature (532°F). The moderator temperature coefficient was calculated by subtracting the predicted isothermal Doppler coefficient from the measured temperature coefficient.

B. All Rods Out Boron Concentration Measurement

The RCS equilibrium boron concentration was measured with Groups 1-6 at 100% wd, Group 7 at 89.5% wd, and APSR Group 8 at 35.0% wd. The control rods were moved to their all-rods-out position (Groups 1-7 at 100% wd, Gp. 8 at 35% wd) and the associated reactivity change was converted to ppmB. The All Rods Out Boron concentration was then calculated and verified to be within 50 ppmB of its predicted value.

C. Control Rod Integral Worths and Differential Boron Worth Measurement

The worths of CR Groups 5, 6, and 7 were measured by steadily deborating the RCS and compensating for the resulting positive reactivity addition by inserting (in discrete steps of ~1200 μρ) the control rods from 100% wd on Group 7 to 0% wd on Group 5 (with <u>no</u> rod overlap). The reactivity changes resulting from the discrete control rod insertions were summed for each group to obtain the group integral rod worth.

The differential boron worth was calculated by dividing the total rod worth of groups 5, 6, and 7 inserted during the rod worth measurements by the corresponding change in RCS boron concentration. The initial value for the boron concentration was recorded at ARO critical equilibrium conditions. The final value of boron concentration was recorded as reactivity approached steady-state at a rate of change less than 80 μρ/minute.

Each of the three measured groups passed their individual acceptance criteria of +/-15% from predicted. The acceptance criteria for predicted total worth of Groups 5-7 being within 10% deviation of the measured total was also met.

PART II

POWER ESCALATION TEST

1.0 Introduction and Summary

The Oconee 1 Cycle 18 Power Escalation Test was performed between 12/23/97 and 3/2/98 per Station Procedure PT/0/A/0811/01. Testing was performed at 11% Full Power (FP), 14% FP, 20% FP, 40% FP, 45% FP, and 100% FP to verify nuclear parameters upon which the Oconee 1 Cycle 18 safety analysis and Technical Specifications are based. The following tests and verifications were performed:

(a) Initial Core Symmetry Check @ 14% FP;

(b) NSS Heat Balance @ 14% FP, 40% FP, and 100% FP (See Enclosure 3.0);

(c) Incore Detector Checkout @ 11% FP, 40% FP and 100% FP;

(d) Power Imbalance Detector Correlation Slope Measurement @ 45% FP;

(e) Core Power Distribution @ 14% FP, 40% FP, and 100% FP (See Enclosures 4.0-4.3 and 5.0);

(f) All-Rods-Out Critical Boron Concentration @ 100% FP (See Enclosure 1.0).

(g) Excore to Incore Imbalance Calculations at 20% FP, 40% FP, and 100% FP.

The unit reached 14% FP at 0145 on 12/24/97. Low power testing (LPT) was completed at 1222 on 12/27/97. The unit reached 40% FP at 2200 on 12/27/97. Testing at this intermediate plateau was completed at 0830 on 12/28/97. Power was increased to 54% FP. Power Escalation was stopped at this point to place 1A Main Feedwater Pump inservice. At this time the unit developed a Steam Generator tube leak and the decision was made to shut the unit down to repair the tube leak. The unit was shutdown on 12/28/97 at 1632. On 1/19/98 at 0036 during the performance of PT/0/A/305/01, Reactor Manual Trip Test, control rod 7 in Group 5 would not respond to an OUT command. Repeated attempts to latch this rod were unsuccessful. The Group 5 Rod 7 CRDM assembly was removed and replaced on 1/23/98. The new CRDM was successfully latched on 1/25/98. On 1/27/98 at 0047 during heatup from cold shutdown a weld leak occurred on the Pressurizer drain line. The unit returned to Cold Shutdown to repair the leak. CRDTTT was performed on Group 5 on 2/8/98. The Unit was taken critical on 2/10/98 at 1630. The unit reached 65% FP on 2/11/98 at 2000 and was held there to investigate Feedwater Flow and Thermal Power best "swings". Power was subsequently reduced to 57% FP for trouble shooting Feedwater Flows. On 2/14/98 at 1320 I&E began ES testing. During ES testing of Channel 2, 1HP-27 would not go closed using the Control Room switch. A reactor power decrease to hot shutdown was begun on 2/15/98 at 0108. After holds at 9% FP and 8% FP to investigate 1HP-27, the reactor was shutdown on 2/15/98 at 2257. The reactor was taken critical on 2/18/98 at 1732. The power increase was stopped at 70% FP for remaining ICS testing at 0259 on 2/20/98. The reactor reached 100% FP on 2/21/98. Full Power Testing (FPT), consisting of Incore Detector Checkout, Core Power Distribution, NSS Heat Balance and All-Rods-Out Critical Boron, was

performed at this plateau. A secondary precision calorimetric was also completed as the last evolution at this plateau. FPT was concluded at 1800 on 2/26/98. Power Escalation Testing was declared complete on 3/2/98 at 1600.

During this outage the OAC was replaced and a modification was made to the ICS. Several tests were performed on the ICS during startup. These test were controlled by TT/1/B/0326/01 and included, Load Rejection Test at 25% FP, Feedwater Pump Trip Test at 70% FP, Maximum Runback Test at 65% FP, and a Loss of RCP Test at 50% FP.

2.0 NSS Heat Balance/RC Flow Verification

Off-line secondary and primary heat balances were performed at 14% FP, 40% FP, and 100% FP. These tests verified the accuracy of the OAC heat balance program and verified acceptable reactor coolant flow rate. OAC computer points (temperatures, pressures, flow-rates etc.) are trended. Using this data, the Reactor Group POWCALC PC program calculates RCS % design flow, verifies Primary/Secondary Power from the Primary/Secondary heat balance, and compares RPS flow values. The results were compared to OAC averages for the same period, and agreement within 2% FP was verified.

The POWCALC program results demonstrated that the RC flow rate was above that assumed in the core design (110.5% design flow).

Normalization of the plant computer RCS flow constants (used to calculate flow from the primary delta-P instrumentation) was performed at FPT and the on-line power calculations were then verified to agree within 2% FP.

3.0 Core Power Distribution

Core Power Distribution tests were conducted at 14% FP, 40% FP and at 100% FP. These tests verified that reactor power imbalance, quadrant power tilt, and radial/total power peaks did not exceed their respective specified limits. An initial Core Symmetry Check was performed at 14% FP. All acceptance criteria were met.

Specific checks were made as follows:

> Reactor power imbalance was compared to the error adjusted imbalance LOCA limit curve and was verified to be within specified limits (based on Core Operating Limits Report).
>
> The maximum positive incore quadrant power tilt was verified to be less than the error adjusted LOCA limit (based on Core Operating Limits Report).

Prior to performing the radial and total peaking factor comparisons, PT/0/A/0302/06 (Review and Control of Incore Instrumentation Signals) was performed to identify erroneous SPND signals. This test was performed at 11% FP, at 40% FP, and 100% FP.

The radial and total peaking factors were measured and compared to the predicted values at 40% and 100% FP. The following acceptance criteria were applied:

(a) $$\% \text{ Deviation} = \frac{(\text{Predicted} - \text{Measured})}{\text{Measured}} \times 100$$

$$\leq \begin{cases} \pm\ 15\% \text{ for radial peaking factors} \\ \pm\ 20\% \text{ for total peaking factors} \\ \quad \text{(recommended maximum deviation -} \\ \quad \text{not an acceptance criterion)} \end{cases}$$

(b) $$\text{Largest Peak \% deviation} = \frac{(\text{LMP} - \text{LPP})}{\text{LMP}} \times 100$$

$$\leq \begin{cases} +\ 5.0\% \text{ for radial peaking factors} \\ +\ 7.5\% \text{ for total peaking factors} \end{cases}$$

Where: LMP is the largest measured peaking factor
LPP is the largest predicted peaking factor

(c) The full core root mean square radial peaking factor deviation (RMS) for all core locations with operable incore detector strings was limited as follows:

$$\% \text{ RMS deviation} = \sqrt{\frac{\sum_{i=1}^{n} (\text{PPi} - \text{MPi})^2}{n-1}} \times 100 \leq 7.5\%$$

Where: PP = Predicted radial peaking factor
MP = Measured radial peaking factor
n = Total number of operable incore detector strings

Note: OAC computer substitutions for core locations with inoperable detectors was allowed during FPT.

4.0 Power Imbalance Detector Correlation

The Power Imbalance Detector Correlation Test was performed at 45% FP. The purpose of this test was to measure the excore to full incore power imbalance correlation slopes for NI Channels 5, 6, 7, and 8, and to verify these slopes to be equal to or greater than 0.95.

The incore/excore imbalance correlation slope for each NI Channel (5-8) was determined by a least squares fit of excore to incore imbalance indications. A total of 53 incore imbalance points which ranged between -8.21% and +3.03% FP were used. All the slopes were verified to be greater than 0.95.

The correlation slopes for NI Channels 5, 6, 7, and 8 were calculated to be 1.17, 1.17, 1.16, and 1.17, respectively.

5.0 Reactivity Measurement at Power

Per the Oconee Generic Startup Physics Test Program (May 1986 reissue), testing for measurement of reactivity coefficients at power is no longer required. The All Rods Out Critical Boron at Power measurement was made at 100% FP, and the boron anomaly between measured and predicted concentration was verified to be less than 50 ppmB.

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ENCLOSURE 1.0

ALL-RODS-OUT (ARO) CRITICAL BORON CONCENTRATION AND DIFFERENTIAL BORON WORTH RESULTS

	Zero Power ARO Critical Boron Concentration	**At-Power ARO Critical Boron Concentration**	**Differential Boron Worth**
CONDITIONS	Gp 7 @ 100% wd Gp 8 @ 35% wd (Initial critical equilibrium: Gp 7 @ 89.5% wd Gp 8 @ 35% wd 1977 ppmB)	100% FP 5.9 EFPD Gp 7 @ 90% wd Gp 8 @ 36% wd	Initial: Gp 7 @ 90% wd Gp 8 @ 35% wd 1978 ppmB Final: Gp 4 @ 45% wd Gp 5 @ 0% wd Gp 8 @ 35% wd 1561 ppmB
MEASURED VALUE	1979.4 ppmB	1416 ppmB	-0.00799 Δk/k / ppmB
PREDICTED VALUE	1995 ppmB	1431 ppmB	-0.00734 Δk/k / ppmB
DEVIATION	- 15.6 ppmB	-15 ppmB	-8.14% (% Dev.=((Pred.-Meas.)/Meas.)X100%)
ACCEPTANCE CRITERIA	Predicted ± 50 ppmB	Predicted ± 50 ppmB	Measured more positive than -.0133%Δk/k/ppmB and ±15% dev. from pred.

ENCLOSURE 2.0

INTEGRAL GROUP ROD WORTH MEASUREMENTS

PARAMETER	**MEASURED VALUE (%Δk/k)**	**PREDICTED VALUE (%Δk/k)**	**DEVIATION* (%)**	**ACCEPTANCE CRITERION**
Gp 7 Integral Worth	-0.9339	-0.9020	3.42	± 15% Deviation
Gp 6 Integral Worth	-0.9507	-0.9500	0.07	± 15% Deviation
Gp 5 Integral Worth	-1.1731	-1.0930	6.83	± 15% Deviation
Gp 5-7 Integral Worth	-3.0577	-2.9450	3.69	± 10% Deviation

* % Dev. = $\frac{\text{Predicted - Measured}}{\text{Measured}}$ * 100

REACTIVITY COEFFICIENTS

PARAMETER	**CONDITIONS**	**MEASURED VALUE**	**PREDICTED VALUE**	**ACCEPTANCE CRITERIA**
Hot Zero Power Temperature Coefficient (ARO)	T_{ave}=532 F Gp 7 @ 88.8% wd Gp 8 @ 35% wd 1977 ppmB	+0.1525E-4 Δk/k/F	+0.1677E-4 Δk/k/F	Predicted ±0.2E-4 Δk/k/F
Hot Zero Power Moderator Temperature Coefficient (ARO)	T_{ave}=532 F Gp 7 @ 88.8% wd Gp 8 @ 35% wd 1977 ppmB	+0.3227E-4 Δk/k/F	+0.3379E-4 Δk/k/F	Predicted ±0.2E-4 Δk/k/F and Measured ≤+0.5E-4 Δk/k/F

ENCLOSURE 3.0

NSS HEAT BALANCE/RC FLOW VERIFICATION

Test Plateau	Plant Computer Online Primary Power Level (%FP)	Plant Computer Online Sec. Power Level (%FP)	Offline* Calculated Primary Power Level	Offline* Calculated Secondary Power Level	RCS* Flow (%DF)
LPT	14.26	14.11	14.30	13.93	115.32
IMPT	39.78	40.20	39.71	40.20	114.24
FPT	101.74	99.79	101.64	99.74	114.71
FPT (adjusted constants)	99.82	99.95	99.70	99.93	112.42

* Calculated by the offline secondary heat balance program (POWCALC).

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ENCLOSURE 4.0

RADIAL PEAKING FACTORS AT IMPT

Reactor Power	Boron Concentration	Gp. 7	GP8
40.30	1672 ppmB	54	49.97

	8	9	10	11	12	13	14	15
H	1,1,Gp4 1.16 1.07 8.2%	2,2 1.60 1.58 1.0%	3,4,Gp3 1.49 1.39 7.4%	4,10 1.47 1.46 0.6%	5,14,Gp7 1.23 1.26 -2.0%	6,21 1.35 1.39 -2.9%	7,30,Gp6 0.90 0.93 -3.6%	8,37 0.29 0.29 0.7%
K		9,3,Gp3 1.49 1.41 5.6%	10,6+8 1.52 1.45 4.7%	11,Inner,Gp1 1.18 1.13 3.8%	12,15+20 1.45 1.50 -3.2%	13,22+29,Gp5 1.25 1.23 1.5%	14,31+36 1.02 1.05 -3.2%	15,45 0.24 0.24 -0.7%
L			16,12,Gp6 1.44 1.35 6.7%	17,17+18 1.52 1.56 -2.4%	18,24+27,Gp8 1.31 1.29 1.7%	19,Outer 1.20 1.25 -3.7%	20,38+44,Gp4 0.51 0.51 0.5%	21,46 0.16 0.16 -2.4%
M				22,26,Gp5 1.41 1.42 -0.6%	23,33+34 1.36 1.34 1.6%	24,40+42,Gp2 0.95 0.96 -0.3%	25,49 0.31 0.31 -0.2%	
N					26,41,Gp7 0.97 0.99 -1.8%	27,48 0.85 0.88 -3.4%	28,51 0.19 0.20 -5.5%	
O						29,52 *		

W	=> 1/8 Core # (1-29), SPND # (1-52), CR Gp (1-8)
X	=> SIMULATE (Predicted)
Y	=> OAC (Measured)
Z	=> % Deviation: ((Pred.- Meas.)/Meas.)*100

1.60	=> SIMULATE Maximum Radial Peak
1.58	=> OAC Maximum Radial Peak
-1.0%	=> LP % Deviation (<+5%): ((Meas.- Pred.)/Meas.)*100

8.2%	=> Maximum 1/8 Core % Deviation (<+15%)
-3.7%	=> Minimum 1/8 Core % Deviation (>-15%)
5.1%	=> % RMS Deviation (<+7.5%)

* Detector not operable

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ENCLOSURE 4.1

TOTAL PEAKING FACTORS AT IMPT

TOTAL PEAKS OF SIMULATE VERSUS OAC

Reactor Power	Boron Concentration	Gp 7	GP8
40.3	1672 ppmB	54	49.97

	8	9	10	11	12	13	14	15
H	1,1,Gp4 1.56 1.37 13.9%	2,2 2.19 2.08 5.5%	3,4,Gp3 2.08 1.85 12.5%	4,10 2.18 2.04 6.8%	5,14,Gp7 2.09 2.03 3.1%	6,21 2.08 2.07 0.3%	7,30,Gp6 1.32 1.30 1.9%	8,37 0.42 0.39 7.7%
K		9,3,Gp3 2.05 1.88 8.8%	10,6+8 2.12 1.95 9.2%	11,Inner,Gp1 1.70 1.55 9.5%	12,15+20 2.22 2.17 2.4%	13,22+29,Gp5 1.89 1.80 5.1%	14,31+36 1.51 1.49 1.5%	15,45 0.34 0.32 7.4%
L			16,12,Gp6 2.04 1.84 11.0%	17,17+18 2.23 2.17 2.7%	18,24+27,Gp8 2.02 1.90 6.5%	19,Outer 1.81 1.80 1.0%	20,38+44,Gp4 0.74 0.70 6.9%	21,46 0.23 0.21 7.2%
M				22,26,Gp5 2.11 2.01 5.1%	23,33+34 2.11 2.01 5.0%	24,40+42,Gp2 1.46 1.42 3.0%	25,49 0.46 0.44 4.7%	
N					26,41,Gp7 1.69 1.58 6.8%	27,48 1.37 1.38 -0.8%	28,51 0.29 0.28 3.9%	
O						29,52 *		

W	=>	**1/8 Core # (1-29), SPND # (1-52), CR Gp (1-8)**
X	=>	**SIMULATE (Predicted)**
Y	=>	**OAC (Measured)**
Z	=>	**% Deviation: ((Pred.- Meas.)/Meas.)*100**

2.23	=>	**SIMULATE Maximum Total Peak**
2.17	=>	**OAC Maximum Total Peak**
-2.7%	=>	**LP % Deviation (<+7.5%): ((Meas.- Pred.)/Meas.)*100**

13.9%	=> **Maximum 1/8 Core % Deviation (<20%)**

-0.8%	=> **Minimum 1/8 Core % Deviation (>-20%)**

* Detector not operable

ENCLOSURE 4.2

RADIAL PEAKING FACTORS AT FPT

Reactor Power	Boron Concentration	Gp. 7	GP8
100.00	1422 ppmB	90	36

	8	9	10	11	12	13	14	15
H	1,1,Gp4 1.08 1.04 3.4%	2,2 1.47 1.50 -1.9%	3,4,Gp3 1.41 1.35 4.2%	4,10 1.45 1.48 -2.4%	5,14,Gp7 1.37 1.37 0.2%	6,21 1.39 1.41 -1.7%	7,30,Gp6 0.92 0.96 -4.3%	8,37 0.30 0.31 -2.1%
K		9,3,Gp3 1.38 1.36 1.8%	10,6+8 1.43 1.41 1.4%	11,Inner,Gp1 1.15 1.13 2.3%	12,15+20 1.45 1.48 -1.8%	13,22+29,Gp5 1.27 1.24 2.6%	14,31+36 1.04 1.08 -3.5%	15,45 0.25 0.25 -1.2%
L			16,12,Gp6 1.37 1.32 3.7%	17,17+18 1.46 1.49 -2.0%	18,24+27,Gp8 1.28 1.24 2.9%	19,Outer 1.20 1.24 -3.0%	20,38+44,Gp4 0.52 0.53 -1.5%	21,46 0.16 0.16 1.1%
M				22,26,Gp5 1.39 1.39 0.1%	23,33+34 1.38 1.38 0.4%	24,40+42,Gp2 0.99 0.98 1.1%	25,49 0.32 0.33 -1.7%	
N					26,41,Gp7 1.11 1.07 4.2%	27,48 0.93 0.94 -1.5%	28,51 0.20 0.21 -2.9%	
O						29,52 *		

W	=> 1/8 Core # (1-29), SPND # (1-52), CR Gp (1-8)
X	=> SIMULATE (Predicted)
Y	=> OAC (Measured)
Z	=> % Deviation: ((Pred.- Meas.)/Meas.)*100

1.47	=> SIMULATE Maximum Radial Peak
1.50	=> OAC Maximum Radial Peak
1.9%	=> LP % Deviation (<+5%): ((Meas.- Pred.)/Meas.)*100

4.2%	=> Maximum 1/8 Core % Deviation (<+15%)
-4.3%	=> Minimum 1/8 Core % Deviation (>-15%)
3.5%	=> % RMS Deviation (<+7.5%)

* Detector not Operable

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ENCLOSURE 4.3

TOTAL PEAKING FACTORS AT FPT

Reactor Power	Boron Concentration	Gp 7	GP8
100	1422 ppmB	90	36

	8	9	10	11	12	13	14	15
H	1,1,Gp4 1.33 1.24 7.5%	2,2 1.85 1.84 0.7%	3,4,Gp3 1.76 1.65 6.9%	4,10 1.83 1.81 1.2%	5,14,Gp7 1.77 1.71 3.6%	6,21 1.78 1.79 -0.7%	7,30,Gp6 1.17 1.19 -1.9%	8,37 0.38 0.37 2.1%
K		9,3,Gp3 1.73 1.67 3.8%	10,6+8 1.79 1.73 3.6%	11,Inner,Gp1 1.43 1.37 4.2%	12,15+20 1.84 1.85 -0.6%	13,22+29,Gp5 1.61 1.56 3.0%	14,31+36 1.33 1.35 -1.2%	15,45 0.31 0.29 6.2%
L			16,12,Gp6 1.71 1.62 5.8%	17,17+18 1.83 1.86 -1.6%	18,24+27,Gp8 1.65 1.60 3.5%	19,Outer 1.52 1.57 -3.5%	20,38+44,Gp4 0.65 0.65 0.7%	21,46 0.20 0.20 0.5%
M				22,26,Gp5 1.75 1.72 1.7%	23,33+34 1.76 1.77 -0.8%	24,40+42,Gp2 1.24 1.24 0.3%	25,49 0.40 0.40 0.6%	
N					26,41,Gp7 1.44 1.37 5.2%	27,48 1.20 1.21 -0.9%	28,51 0.26 0.25 2.3%	
O						29,52 *		

W	=>	1/8 Core # (1-29), SPND # (1-52), CR Gp (1-8)
X	=>	SIMULATE (Predicted)
Y	=>	OAC (Measured)
Z	=>	% Deviation: ((Pred.- Meas.)/Meas.)*100

1.85	=>	SIMULATE Maximum Total Peak
1.86	=>	OAC Maximum Total Peak
0.4%	=>	LP % Deviation (<+7.5%): ((Meas.- Pred.)/Meas.)*100

7.5%	=> Maximum 1/8 Core % Deviation (<20%)

-3.5%	=> Minimum 1/8 Core % Deviation (>-20%)

* Detector not Operable

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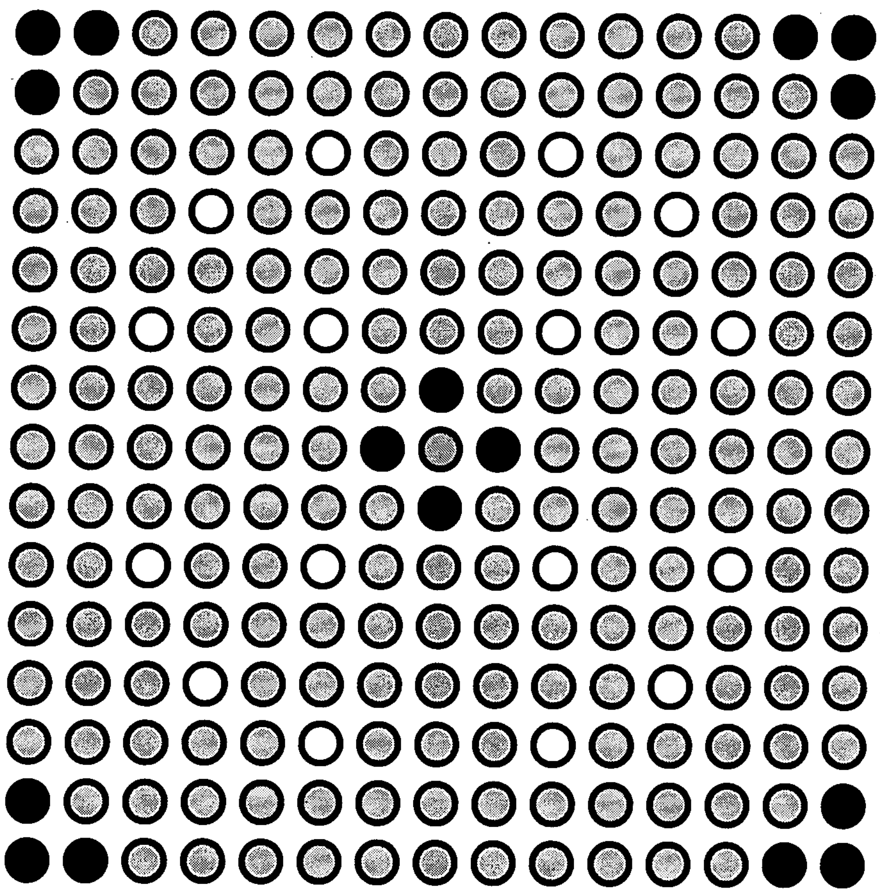
ENCLOSURE 5.0

CORE POWER DISTRIBUTION DATA SUMMARY AT

LPT, IMPT AND FPT PLATEAUS

Power Level (% FP)	14	40	100
Burnup (EFPD)	0.02	0.73	6.20
Group 6/7/8 Positions (% wd)	48.7/0/35.8	100/54/50	100/90/36
RCS Boron Concentration (ppmB)	1656	1672	1422
Incore Imbalance (% FP)	-3.65	-5.70	-5.05
Incore Tilt WX/XY YZ/ZW	-3.46/+2.36 +1.99/-0.90	-2.76/+1.91 +2.06/-1.21	-1.29/+1.22 +0.94/-0.87

Enclosure 6.0
Batch 20 Fresh Fuel Assemblies
Pin Map Showing Layout for the Mk-B10L, Radial Zoned, Fuel Assemblies



- One (1) Instrument Tube
- Sixteen (16) Empty Guide Tubes
- 192 Fuel Pins at 3.61 wt% U235
- 16 Fuel Pins at 3.31 wt% U235